1.0

4 5
5 0

2.8

2.5

3.2

2.2

3 6

1.1

4 0

2.0

1.8

1.25

1.4

1.6

MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS 1963 A

ADA086025

NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER

Bethesda, Md. 20084
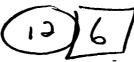
LEVEL

⑥ BANDIT USER'S GUIDE.
Revision B.

⑩ Gordon C. Everstine

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⑪ Dec 78

COMPUTATION, MATHEMATICS AND LOGISTICS DEPARTMENT
TECHNICAL MEMORANDUM

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BANDIT User's Guide

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1. <u>BANDIT version:</u> version 9, updated 12/4/78

2. <u>Compatible NASTRAN Versions:</u> NASA's level 17 (and below), MSC NASTRAN,
   Navy NASTRAN

3. <u>Input:</u>

   a. <u>maximum:</u> a standard NASTRAN data deck (ID or NASTRAN thru ENDDATA)
      plus $ option cards, if any

   b. <u>minimum:</u> $ option cards, BEGIN BULK, element connection cards,
      ENDDATA

4. <u>Output:</u>

   a. printed output

   b. punched output (SEQGP cards or entire deck)

   c. file (unit 8) containing complete deck plus SEQGP cards; this file
      is suitable to be used as input to NASTRAN

5. <u>Elements Recognized:</u>

CELAS1	CELAS2	CDAMP1	CDAMP2	CMASS1
CMASS2	CROD	CTUBE	CVISC	CDAMP3
CDAMP4	CELAS3	CELAS4	CMASS3	CMASS4
CAXIF2	CAXIF3	CAXIF4	CBAR	CCONEAX
CFLUID2	CFLUID3	CFLUID4	CHBDY	CHEXA1
CHEXA2	CHTTRI2	CIS2D4	CIS2D8	CIS3D8
CIS3D20	CONM1	CONM2	CONROD	CQDMEM
CQDMEM1	CQDMEM2	CQDPLT	CQUAD1	CQUAD2
CSHEAR	CSLOT3	CSLOT4	CTETRA	CTORDRG
CTRAPRG	CTRBSC	CTRIA1	CTRIA2	CTRIARG
CTRMEM	CTRPLT	CTWIST	CWEDGE	CDUMMY
CDUM1	CDUM2	CDUM3	CDUM4	CDUM5
CDUM6	CDUM7	CDUM8	CDUM9	CTRIAX6
CTRIM6	CDAMP4%	CELAS4%	CMASS4%	CDAMP2%
CELAS2%	CMASS2%	CONM1%	CONM2%	CONROD%
CIHEX1	CIHEX2	CIHEX3	CTRAPAX	CTRIAAX
CQUADTS	CTRIATS	CQDMEM3	CHEX8	CHEX20
CTRPLT1	CTRSHL	CRIGD1	CRIGD2	CRIGDR
CBEAM	CFTUBE	CHEXA	CPENTA	CQUAD4
CTRIA3				

6. <u>Reduction Approach:</u> Uses Cuthill-McKee (CM) and/or Gibbs-Poole-Stockmeyer (GPS) methods to reduce matrix bandwidth, profile, wavefront, or rms wavefront.

7. <u>Core Requirements:</u>

Total Core = Program + Working Storage

   where   Program = $47K_8$ words on CDC

                = 145K bytes on IBM

                = 24K words on UNIVAC, Honeywell

Working Storage Required = $(\frac{M}{NW} + 8)N$

   where   N = number of grid points

           M = maximum nodal degree (the maximum number of nodes connected to any node)

      NW = integer packing density (integers/word)

      Working Storage = open core on open core versions of BANDIT

CDC: NW = 6 for N ≤ 510

             5 for 510 < N ≤ 2045

             4 for 2045 < N ≤ 16380

             3 for 16380 < N ≤ 524286

IBM: NW = 2   for   N ≤ 32766

UNIVAC, Honeywell: NW = 4 for N ≤ 508

                          3 for 508 < N ≤ 4095

                          2 for 4095 < N ≤ 262142

8. <u>$ Option Cards:</u>

   a. <u>location:</u> anywhere before BEGIN BULK

   b. <u>general format:</u> $KEYWORD1 KEYWORD2

   c. <u>rules:</u>

      (1) $ in column 1

      (2) KEYWORD1 starts in column 2

      (3) keywords separated by one or more blanks

      (4) no embedded blanks in keywords

      (5) the first two letters of each keyword are required for recognition

9. **$ Option Cards:** (default underlined)

   a. **For General Use:**

$SEQUENCE (NO, <u>YES</u>)   Is resequencing to be performed?

$GRID N   Upper bound on number of grid points.

This card must be used with solid elements and MPC's since default M (maximum nodal degree) is about 19. It is recommended to use it with all runs since it is used for efficient allocation of core.

$CONFIG N   Computer model (from NASTRAN manual).

Used in estimating NASTRAN decomposition time.

$CONFIG N,M,L   N = computer model (from NASTRAN manual)

                              M = computer for which decomposition time estimate is desired if different from one BANDIT is on (M=1 for CDC, 2 for IBM, 3 for UNIVAC).

                              L = flag to request printout of all NASTRAN multiply-add time constants (0 = no, 1 = yes)

$PUNCH (NONE, <u>SEQGP</u>, ALL) What should be punched?

$CRITERION (BAND, PROFILE, WAVEFRONT, <u>RMS</u>) What should be reduced?

    Recommendations:

        BAND for NASTRAN Level 15.5 and below
        RMS for NASTRAN Level 15.9 and above and MSC NASTRAN

$METHOD (CM, GPS, <u>BOTH</u>) By what method?

$MPC (<u>NO</u>, YES)   Take MPC's into account?

"YES" generates, for each MPC equation in deck, additional connections between the independent points and every other point to which the dependent point is connected. Dependent points can be eliminated from connection table by using $IGNORE.

$PRINT (<u>MIN</u>, MAX)   What printed output?

"MIN" is adequate for most purposes. "MAX" generates additional connection tables and nodal lists.

$IGNORE G1,G2,...   Grid points to ignore.

Nodes ignored are eliminated from the connection table and sequenced last. This should be used, for example, for nodes of very high degree compared to other nodes in the structure.

$ADD N   Add N to new sequence numbers.

May be used to avoid duplication of internal numbers if not all nodes of a structure are being sequenced in one run.

3

```
$ELEMENTS (NO, YES)        List BANDIT's element library?

$APPEND CNAME NCON IFLD    User-defined connection card.
```

CNAME = name of connection card (e.g., CBAR) left-adjusted starting in column 9.

NCON = number of connections on card (i.e., nodes in element) ≥ 1.

IFLD = NASTRAN field number on parent card in which first connection appears ≤ 9.

NCON and IFLD may appear anywhere in columns 17-32 separated by one or more blanks. No long-field connection cards may be defined. Connections must be listed consecutively on parent and continuation cards, if any. Each $APPEND card defines a new element type.

b. For Particular Users:

```
$NASTRAN (NO, YES)         NASTRAN to follow BANDIT? (IBM)
```

"YES" generates a condition code 5 after a successful completion.

```
$INSERT                    Location of cards to insert.

$INSERT N                  Number and location of cards to insert.
```

May be used by remote users to insert checkpoint dictionary from disk file into executive control deck.

```
$LINES N                   Number of printed lines per page.

$PLUS +                    User-defined plus sign.
```

Allows user to input his own special plus sign, if necessary.

```
$DIMENSION N               Dimension of a scratch array.

$HICORE N                  Amount of core requested in words. (UNIVAC)
```

c. For Program Developer :

```
$TABLE (NO, YES)           Output connection table?

$START  G1,G2,...          User-supplied CM starting nodes.

$DEGREE N                  Ignore nodes of degree exceeding N.

$SPRING (NO, YES)          Generate scalar springs?
```

The springs (CELAS3) have same connectivity as original structure.

10. Installation-dependent Remarks:

a. On CDC machines, the automatic reduction of field length at execution time should be suppressed, e.g., with an RFL card.

b. Unless modified locally, IBM and Honeywell versions are not open core programs, but fixed core. Hence, calls by BANDIT for more core require the change of two statements in the main program.

11. Additions to BANDIT version 9:

    a. Open core and HICORE on UNIVAC.

    b. Eliminate backspace of Unit 5 on IBM and Honeywell.

    c. Min. nodal degree printout in summary.

    d. User-selected CM starting nodes fix.

    e. Case Control card counter.

    f. New Level 17 configurations and time constants.

    g. Subroutine READIT efficiencies.

    h. Recovery of SEQGP cards generated by CM if abort in GPS due to exceeding scratch dimension.

    i. $APPEND card to define connection card at execution time.

    j. CRIGD1 with THRU option.

    k. Warning for illegal ENDDATA format.

    l. Optional printout of multiply-add time constants.

    m. Reset of $DIMENSION value if $GRID declared.

    n. Time and disk space efficiencies with MPC equations.

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